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A3273-8

Vol. 58 No. 11 November 1983

JOURNAL OF

Medical Education

PUBLICATION OF THE ASSOCIATION OF AMERICAN MEDICAL COLLEGES

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COMMUNICATIONS

Trends in Teaching Systems Courses In American Medical Schools, 1975-1983

Charles G. Atkins, Ph.D.

The organization of courses around a given organ system began many years ago and has been adopted into the curricula of numerous medical schools in the United States and Canada. Although different phrases have evolved as synonyms (for example, systems biology and committee course), the systems courses have several common characteristics that set them apart from the traditional basic science courses that are organized around a particular specialty or department. Among these characteristics, in addition to the organ systems emphasis, are the multidisciplinary nature of the courses, the larger number of credit and contact hours, and the goal of interrelating the many concepts of the system toward a better understanding of the system as a whole.

In some medical schools, introductory courses in the traditional discipline precede the systems courses; in other medical schools, the incoming student begins with these integrated classes. In the present study, the former type of curriculum is labeled combined curriculum, while the latter type is referred to as systems curriculum. Curriculum organized around specialty areas is designated as traditional curriculum. Integrated traditional curriculum refers to a curriculum which presents traditional basic science and clinical material in an integrated manner that de-emphasizes traditional specialties (the focal problems method, for example).

The basic goal of the study is to measure the utilization of the organ systems curriculum in the medical schools of the United States and Canada over the past eight years.

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Method

The data for the study were obtained from the annual editions of the *Curriculum Directory* published by the Association of American Medical Colleges (AAMC) for the years 1975-76 through 1982-83. Each medical school was classified by the present author as to whether its curriculum was traditional; systems; combined systems and traditional; traditional, but with one, two, or three systems courses; integrated traditional; or not categorized (because of insufficient information). Most often, the reason for placing a school in the fourth group was that traditional courses made up the bulk of its curriculum, but there were several (one to three) courses which were organized around an organ system. Courses with names such as neurosciences, reproduction, and endocrinology were not interpreted as being systems courses unless the presence of other systems courses indicated that they were part of a systems or combined curriculum. Likewise, on occasion, a pathophysiology course was subdivided into organ systems. However, since these courses were not multidisciplinary and did not fit the above description of systems courses, these were not classified as such.

Results and Discussion

The AAMC data obtained from annual surveys of U.S. medical schools are shown in Table 1. Since the number of medical schools increased between 1975 and 1983, the percent of schools utilizing a curriculum type gives a better indication than does the number of schools. These figures show a steady decline in the percent of schools using a systems or combined curriculum from the 1976-77 academic year to 1981-82. Use of systems courses, either combined with traditional

TABLE 1
Number and Percentage of Five Types of Curriculum in U.S. Medical Schools, 1975 to 1983

Curriculum Category	1975-76		1976-77		1977-78		1978-79		1979-80		1980-81		1981-82		1982-83	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Traditional	76	63.9	73	60.8	81	65.8	91	70.0	94	71.7	97	74.0	100	75.8	100	77.0
Systems	10	8.4	11	9.2	5	4.1	6	4.6	6	4.6	5	3.8	5	3.8	5	3.8
Combined	23	19.3	25	20.8	29	23.6	25	19.2	24	18.3	22	16.8	19	14.4	19	14.6
Traditional with 1 to 3 systems courses	2	1.7	2	1.7	2	1.6	1	0.8	1	0.8	2	1.5	2	1.5	2	1.5
Integrated traditional	6	5.0	8	6.7	5	4.1	6	4.6	5	3.8	4	3.1	5	3.8	3	2.3
Not categorized	2	1.7	1	0.8	1	0.8	1	0.8	1	0.8	1	0.8	1	0.8	1	0.8
Subtotal	119	100	120	100	123	100	130	100	131	100	131	100	132	100	130	100
All traditional* Systems and combined courses	84	71.8	83	69.7	88	72.1	98	76.0	100	76.9	103	79.2	107	81.7	105	81.4
Subtotal	33	28.2	36	30.3	34	27.9	31	24.0	30	23.1	27	20.8	24	18.3	24	18.6
Subtotal	117	100	119	100	122	100	129	100	130	100	130	100	131	100	129	100

* Traditional, traditional with 1 to 3 systems courses, and integrated traditional curriculum categories.

courses or not, peaked in 1976-77 at 30.3 percent. The slight percent increase in 1982-83 is a reflection of fewer schools in the survey and not of an increase in the popularity of the systems approach. Although the differences from year to year are not statistically significant (even between 1977-78 and 1978-79 academic years when there was a 3.9 percent decrease), the difference from the beginning to the end of the study was found to be significant ($\chi^2 = 6.11, p < .05$).

A similar analysis was made of the Canadian medical schools listed in the *Curriculum Directory* over the same eight-year period. Unlike the medical schools of the United States, the number of Canadian schools held constant at 16 during this eight-year period. For all but two of the eight years, their utilization of systems curricula remained the same. Seven (43.8 percent) of the Canadian schools utilized a traditional curriculum, and nine (56.2 percent) utilized a systems or combined systems approach in their curricula.

Utilizing 14 medical schools in the United

States where the hours in each organ systems course could be clearly demarcated, the author ascertained the eight most commonly occurring systems courses. They are as follows, with the number after each being the average number of hours taught over the three-year period from 1980 to 1983: neural, 127.3 hours; cardiovascular, 91.8 hours; gastrointestinal, 83.9 hours; respiratory, 76.8 hours; musculoskeletal, 73.1 hours; reproduction, 67.2 hours; endocrinology, 64.6 hours; and renal-urinary, 62.1 hours.

Conclusions

The use of systems or combined systems curriculum in the medical schools of the United States has decreased significantly over the last eight years to the point that it is currently in use in less than one-fifth of the country's medical schools. By contrast, over half of the Canadian medical schools use a systems curriculum, and there has been no decrease in its use over the same eight-year period from 1975 to 1983.

DATAGRAM

The Relationship Between MCAT Science Scores And Undergraduate Science GPA

A major limiting factor in the use of undergraduate college grades as an unbiased indicator of academic achievement for medical school admissions decisions is the variability in the meaning of grades achieved at diverse undergraduate institutions. Even after the conversion of various grading systems by the American Medical College Application Service to a four-point scale, the commonality of the grade-point averages (GPAs) examined by admissions committee members is only on paper. Identical numbers may reflect differing levels of achievement. Medical schools recognize this problem and tend to deal with it in two ways: (a) by a formal weighting of GPA based on some measure of the quality or selectivity of the undergraduate institution, or (b) by an informal weighting based on the school's experience with graduates of that institution, which contributes to the overall impression of the candidate. In both cases, Medical College Admission Test (MCAT) scores are used for confirmation of the student's level of achievement.

The purpose of the authors in this datagram is to document the variability in the meaning of grades by using the MCAT scores as a criterion. In so doing, the authors explore the correspondence between MCAT scores and undergraduate GPA of medical school applicants and the role that selectivity in admissions of the undergraduate college plays in moderating this relationship. Undergraduate science GPA and scores on the four MCAT science areas of assessment were the particular focuses of the study.

The data are based on all applicants to the 1981-82 entering class for whom complete information was available ($n = 32,271$). The applicants were distributed into four groups corresponding with the selectivity of their undergraduate college. The college selectivity measure used is one commonly known as the Astin index (1), which provides the average combined Scholastic Aptitude Test score of

entering freshman students at each college or university. Index data for 1977 were used for the study. Each of the 32,271 1981-82 medical school applicants was assigned the selectivity score of the college or university he had attended. The resulting distribution had a mean of 1037 and a standard deviation of 144, with a range of 550 to 1420. Selectivity groups were defined by various points on this distribution as follows:

Low selectivity—892 or less (greater than -1 standard deviations below the mean).

Medium selectivity—893 to 1036 (0 to -1 standard deviations).

High selectivity—1037 to 1181 (0 to +1 standard deviations).

Very high selectivity—1182 or more (greater than +1 standard deviations above the mean).

Table 1 provides means and standard deviations for each MCAT science score separately by selectivity of undergraduate college and science GPA. Figure 1 illustrates the relationship of the selectivity, the science GPA, and the average of the four MCAT science areas of assessment. Two observations can be made from Figure 1 that apply similarly to the data in the table. The first is that there is a positive and fairly linear trend in the relationship between the MCAT science average and the science GPA, at least for GPAs between 2.51 and 3.80, at all four types of colleges. This is summarized by Pearson correlation coefficients of approximately .5, shown in Table 1. A sharper downturn in MCAT performance is shown for those with GPAs below 2.51. However, this is likely the result of aggregating all applicants with GPAs below 2.51. A sharper upturn in MCAT performance is shown for those with GPAs above 3.8, particularly at high, medium and low selectivity colleges. This may be explained by a "ceiling effect" for the GPA for students at those schools, which does not occur with the MCAT.

The second observation is that, despite sim-

TABLE 1

Means, Standard Deviations, and Correlations of MCAT Science Scores by Undergraduate Science GPA and Selectivity of Undergraduate College (SUC) of 32,271 Applicants to U.S. Medical Schools in 1981-82*

MCAT Subtest/SUC	Science GPA								MCAT/ Science GPA Correlation
	0- 2.50	2.51- 2.80	2.81- 3.00	3.01- 3.20	3.21- 3.40	3.40- 3.61	3.61- 3.80	3.81- 4.00	
Biology									
Very High									
Mean	7.70	8.56	9.28	9.50	9.82	10.10	10.31	10.82	.42
S.D.	2.29	2.13	1.83	1.72	1.65	1.66	1.59	1.63	
High									
Mean	7.08	8.26	8.69	8.94	9.34	9.61	9.92	10.34	.41
S.D.	2.37	2.25	2.07	2.06	1.93	1.86	1.82	1.79	
Medium									
Mean	6.69	7.48	8.01	8.28	8.56	8.86	9.16	9.62	.38
S.D.	2.37	2.26	2.14	2.13	2.05	1.93	1.93	1.98	
Low									
Mean	5.56	6.70	6.78	7.53	7.72	8.06	8.31	8.87	.41
S.D.	2.32	2.39	2.40	2.26	2.32	2.17	2.07	2.10	
Chemistry									
Very High									
Mean	7.47	8.48	9.18	9.46	9.96	10.40	10.96	11.70	.54
S.D.	2.00	1.87	1.77	1.74	1.73	1.72	1.67	1.71	
High									
Mean	6.75	7.87	8.27	8.80	9.24	9.66	10.10	11.01	.53
S.D.	1.94	2.03	1.91	1.97	1.86	1.91	1.85	1.79	
Medium									
Mean	6.26	6.94	7.57	7.84	8.28	8.65	9.14	10.03	.49
S.D.	1.84	2.03	1.91	1.97	1.86	1.91	1.85	1.79	
Low									
Mean	5.39	6.23	6.52	7.10	7.40	7.72	8.21	9.04	.48
S.D.	1.70	1.94	1.99	1.93	2.04	2.04	2.03	2.09	
Physics									
Very High									
Mean	7.36	8.37	9.19	9.52	9.95	10.51	10.98	11.66	.51
S.D.	2.06	2.16	1.94	1.91	1.83	1.95	1.87	1.95	
High									
Mean	6.70	7.87	8.27	8.81	9.25	9.67	10.14	10.89	.49
S.D.	2.16	2.20	2.03	2.06	2.04	2.03	1.98	2.06	
Medium									
Mean	6.40	6.99	7.60	7.85	8.27	8.59	8.99	9.86	.43
S.D.	1.99	1.98	1.99	2.07	2.04	2.04	2.06	2.19	
Low									
Mean	5.50	6.32	6.58	7.14	7.41	7.73	8.24	8.85	.44
S.D.	1.74	2.01	2.15	2.09	2.10	2.16	2.21	2.21	
Science Problems									
Very High									
Mean	7.42	8.46	9.16	9.42	9.88	10.31	10.71	11.53	.50
S.D.	2.04	2.03	1.86	1.77	1.72	1.83	1.76	1.88	
High									
Mean	6.79	7.89	8.34	8.71	9.16	9.56	10.01	10.78	.49
S.D.	2.12	2.10	1.94	2.00	1.94	1.95	1.92	2.02	
Medium									
Mean	6.36	7.03	7.64	7.83	8.25	8.59	8.96	9.77	.44
S.D.	1.96	1.96	1.92	1.99	1.95	1.89	1.96	2.12	
Low									
Mean	5.40	6.32	6.45	7.13	7.32	7.66	8.10	8.84	.45
S.D.	1.79	2.03	2.01	1.99	2.04	2.02	2.06	2.12	

* Data are based on all applicants to the 1981-82 entering class for whom complete information is available: very high = 5,826; high = 9,754; medium = 11,852; low = 4,839. See text for derivation of groups and explanation of selectivity of undergraduate college.

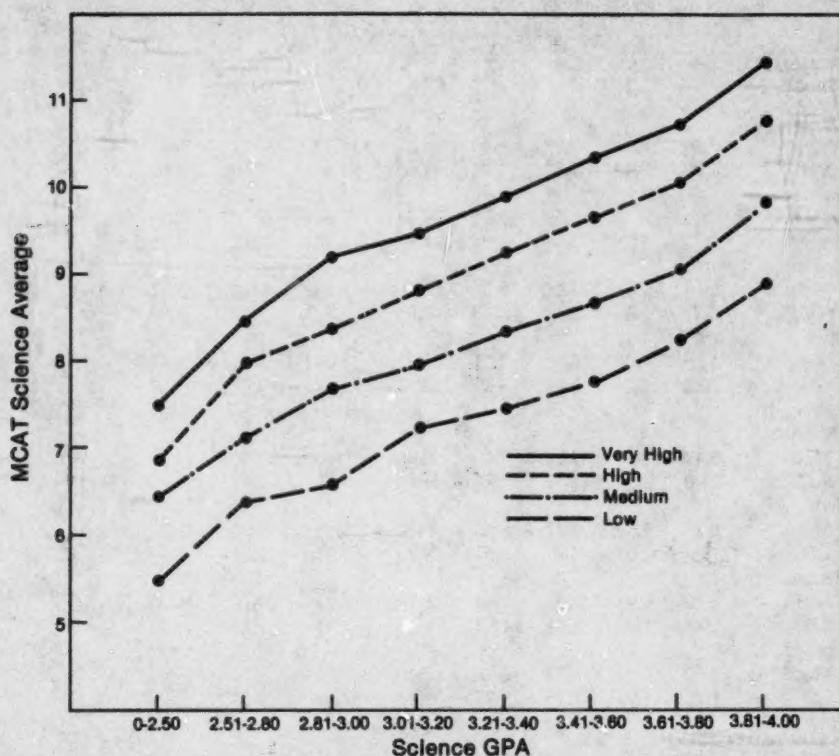


FIGURE 1

Medical College Admission Test (MCAT) science average by undergraduate science grade-point average (GPA) and undergraduate college selectivity, U.S. medical schools, 1981-82 entering classes.

ilarities in the overall trend, there are systematic differences in the MCAT performance of applicants with identical GPAs but from colleges that differ in selectivity. These differences tend to be fairly constant at each point in the GPA scale; they range from 2 to 2.5 scale score points between the low selectivity schools and the very high selectivity schools. One result of this is that whether or not a particular MCAT score is considered to be consistent with GPA depends on the college or university from which the GPA is derived. For example, a 9 in chemistry may be a score typical of those with science GPAs of 3.8 to 4.0 from low selectivity colleges (mean = 9.04). However, this is closest to the score expected of those with science GPAs of 3.6 to 3.8 from medium

selectivity colleges (mean = 9.14), of 3.2 to 3.4 from high selectivity colleges (mean = 9.24), and of 2.8 to 3.0 from very high selectivity colleges (mean = 9.18).

These data support the use of MCAT scores for assisting in the evaluation of academic achievement of medical school applicants. The MCAT complements the information supplied by undergraduate grades, by measuring achievement with standard content and a standard scale. A direct correction or weighting of the GPA, by use of the Astin index or some other measure of quality, can result in a more internally consistent GPA measure. However, this has a social consequence that many consider undesirable. Weighted GPAs tend to place an artificial ceiling on the eval-

uation of achievement for applicants from colleges with lower selectivity scores. The MCAT offers the opportunity for these applicants to demonstrate their achievement irrespective of their undergraduate college origins and, therefore, provides for the social mobility that excessive reliance on the undergraduate college attended might restrict.

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